DoD/IC/USIGS Video Working Group Report to ISMC, 6 March 1998

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6 March 1998

Video Working Group
Recommended Charter Changes

Video Imagery Standards Profile, Versions and Relationships to JTA / UTA

Changes to VISP (From 1.1 to 1.2x)

■ VISP 1.1 was last ISMC approved document (26 Sept. 1997)

– VISP was nominated for inclusion into the Joint Technical Architecture (2.0)

– VISP 1.1 required extensive format (editorial) changes to make the VISP "JTA compliant" - major division of STANDARDS versus EMERGING

– Summary: First revision to 1.11 did editorial changes, no "policy" changes

– Next revision 1.12 added significant new "introduction" material, based on JTA issues (formal definitions of Motion Imagery, Video, etc.)

– Next revision 1.13 added standards for High Definition video

■ Video Working Group met on 19 November, completed VISP 1.2

– Because of sensitivity of high definition issues, put 1.2 out as "provisional," formally asked for comments from government and industry.

– ISMC meeting slip from January to March necessitated rapid change to VISP 1.2 (VISP 1.21) so that 1.21 could be included in JTA 2.0

– Could only include ISMC approved items

– Kept all editorial changes of 1.2, but only the ISMC approved items as Standards

–

DoD/IC/USIGS Technical Architectures Status

■ Joint Technical Architecture (JTA) Status

– JTA 2.0 Drafting and Comments Completed week of March 9th

– VWG Inputs (Section 2.2.2.3.1.4.5 Motion Imagery) basis for JTA 2.0 Final

» VISP 1.21 (7 January 98) is basis for JTA 2.0 Mandated Standards

» VISP 1.3 (6 March 98) is basis for JTA 2.0 Emerging Standards

– May have an opportunity to have VISP 1.3 cited for Mandated Standards

■ USIGS Technical Architecture (UTA) Status

– VISP 1.1, 26 Sept 1997, is referenced in USIGS Technical Architecture (UTA), dated 6 November 1997.

– Next UTA revision (Spring 1998) will point to VISP 1.3

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VIDEO IMAGERY STANDARDS PROFILE
VERSION 1.2x - > VERSION 1.3

Official VWG Chair Objective: Win/Win Compromise

Win / Win Compromise

Interlace (Commercial Interests) VWG Chair Progressive (Government and
Computer Interests)

Changes to VISP (From 1.1 to 1.2x): High Definition

- ■ Conflicting Policy Guidance
  - Under Secretary of Defense, Progressive Format Mandate
  - DoD/IC/USIGS Mandate to migrate to commercial standards where possible
    - » But must have guaranteed interoperability to meet military mission requirements
    - » Current ATSC T3 and DTV-MICL HD1/2 positions are not fully interoperable
  - DoD/IC/USIGS Users will be using Progressive Scan displays/systems
    - » USIGS Architecture, JTA Assumes Use of DII/COE Computer Display Systems
- ■ Video Working Group Charter requires <u>consensus</u> decisions, strict rules
- ■ VWG Chair sincerely wanted a consensus decision
  - Seeking "peace in our time" since 1996
- ■ VWG Chair and Staff prepared preliminary analysis of all received inputs and prepared a list of possible options
- ■

Advanced Television (ATSC Table 3 - 18 Formats)

Horiz.	Vert.	Aspect	Aspect	Frame Rate						
1920	1080	16:9		24p		30p			30i	
1280	720	16:9		24p		30p				60p
704	480	16:9	4:3	24p		30p			30i	60p
640	480		4:3	24p		30p				60p

Advanced Television (Treaty Partner Friendly)

Horiz.	Vert.	Aspect	Aspect	Frame Rate						
1920	1080	16:9		24p	25p		25i			
1280	720	16:9		24p	25p			50p		
720	576	16:9	4:3	24p	25p		25i	50p		
640	480		4:3	24p	25p			50p		

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DTV-MICL Model for HD Reception
(Summary Interpretation)

Horiz.	Vert.	Aspect	Aspect	Frame Rate						
1920	1080	16:9		24p	25p	30p		50p		60p
1280	720	16:9		24p	25p	30p		50p		60p
720	576	16:9	4:3	24p	25p		25i	50p		
720	480	16:9	4:3	24p		30p			30i	60p
640	480		4:3	24p	25p	30p		50p		60p
									HD1	HD2

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Summary Technical Points based on FCC / A.53 Citations

- The Grand Alliance contends that "[t]he system's all-digital layered architecture, its packetized data transport structure, ...**its support of multiple picture formats and frame rates with a heavy emphasis on progressive scan...and its compliance with MPEG-2 international compression and transport standards**, give it unprecedented and unmatched interoperability with computers and telecommunications."

- While these commenters assert that current technology prohibits the use of progressive scanning for images of more than 1000 lines in the 6 MHz channel, they **concede that an all progressive system would be preferred once possible**.

- National Telecommunications and Information Administration...**promote evolution to an all-progressive scan system.**

- **Department of Defense...It strongly favors progressive scanning and square pixels because, it states, they result in operations that are cheaper, faster, and computer compatible for DOD information processing applications**.

- The **Digital Television Standard is based on the ISO/IEC MPEG-2 Video Standard**…

- The ATV video compression algorithm shall **conform to the Main Profile** syntax of ISO/IEC 13818-2. The allowable parameters shall be **bounded by the upper limits specified for the Main Profile at High Level**.

Summary Report to ISMC: HD Receivers

■ Universal Consensus on mandate for RECEIVERS to decode interlace and progressive (also 50 and 60 Hz).

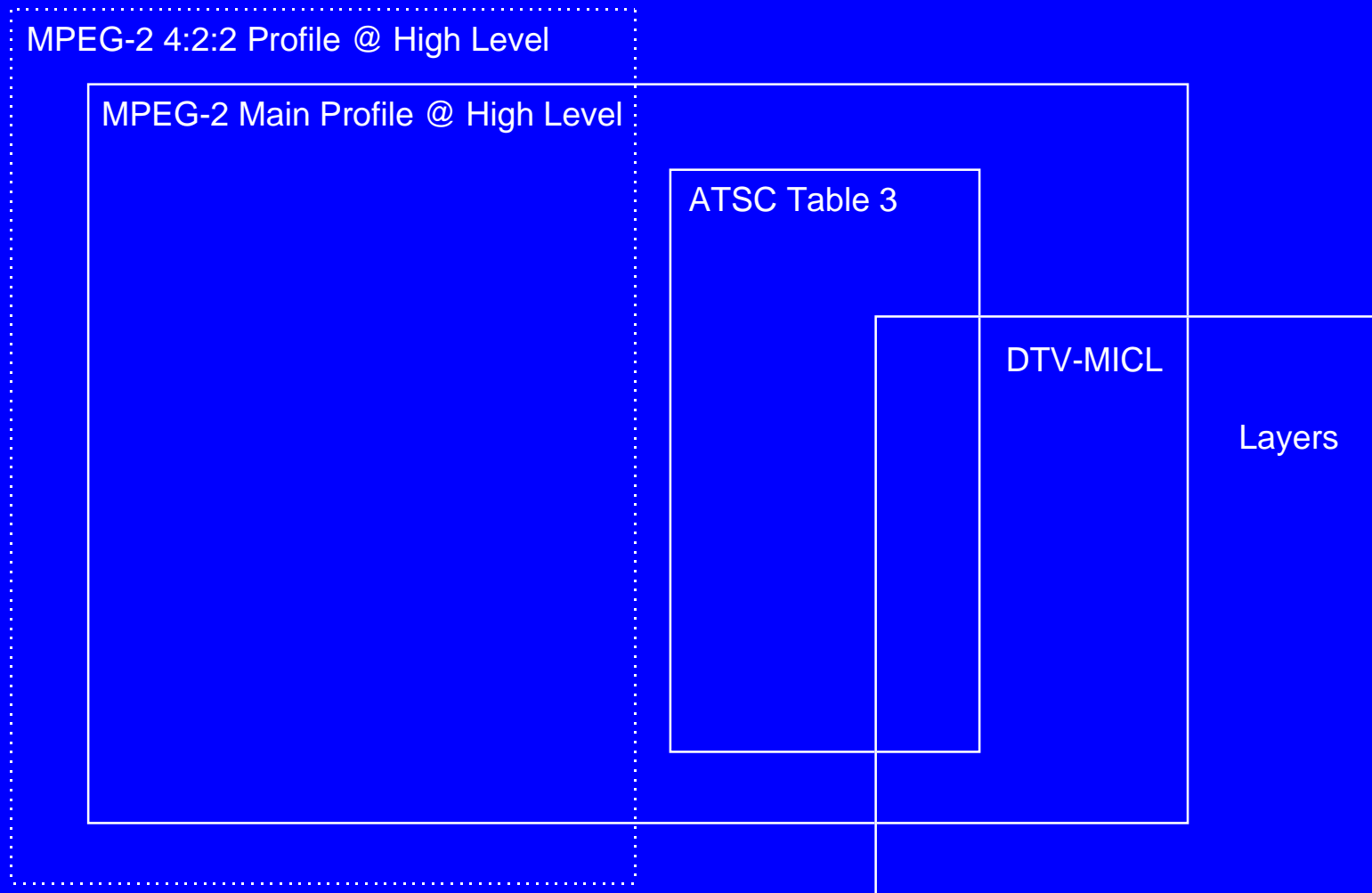■ Significantly improved interoperability by change in VISP to mandate:

– MPEG-2 @ HIGH LEVEL.

Key VWG Technical Architecture Concepts:
MPEG-2 "Profiles and Levels" Provide Maximum Flexibility and Options for Compressed Video

LEVEL / PROFILE	SIMPLE	MAIN	4:2:2	SNR	SPATIAL	HIGH
HIGH		4:2:0 1920 x 1152 80 Mb/s I, P, B	4:2:2 1920 x 1080 250 Mb/s I, P, B			4:2:0, 4:2:2 1920 x 1152 100 Mb/s I, P, B
HIGH-1440		4:2:0 1440 x 1152 60 Mb/s I, P, B			4:2:0, 4:2:2 1440 x 1152 60 Mb/s I, P, B	4:2:0, 4:2:2 1440 x 1152 80 Mb/s I, P, B
MAIN	4:2:0 720 x 576 15 Mb/s I, P	4:2:0 720 x 576 15 Mb/s I, P, B	4:2:2 720 x 608 50 Mb/s I, P, B	4:2:0 720 x 576 15 Mb/s I, P, B		4:2:0, 4:2:2 720 x 576 20 Mb/s I, P, B
LOW		4:2:0 352 x 288 4 Mb/s I, P, B		4:2:0 352 x 288 4 Mb/s I, P, B		

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MPEG-2 / ATSC / DTV-MICL Relationships

MPEG-2 4:2:2 Profile @ High Level

MPEG-2 Main Profile @ High Level

ATSC Table 3

DTV-MICL

Layers

Standard and HD Video Reception (US DoD / Treaty Partners)
Mandate: MPEG-2 MP@HL, Notes for Specific Formats

Horiz.	Vert.	Aspect	Aspect	Frame Rate						
1920	1080	16:9		24p	25p	30p	25i	*50p*	30i	*60p*
1280	720	16:9		24p	25p	30p		50p		60p
720	576	16:9	4:3	24p	25p		25i	50p		
704/720	480**	16:9	4:3	24p		30p			30i	60p
640	480		4:3	24p	25p	30p		50p		60p
** 480 - 486										

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Summary Report to ISMC: HD Origination

■ Government Consensus Reached for ORIGINATION

– All government representatives felt that Under Secretary of Defense guidance very clear - Progressive scanning is in the best interest of DoD.

– Several representatives would not accept interlace under any circumstances

– NIMA Program Manager for Video Technology: Recommendation to adopt Progressive

– VWG Chair: Recommendation to adopt Progressive

■ Split decision from Commercial Sources

– Direct endorsement of VISP by NASA and Microsoft (Progressive Only)

– NIDL and Tektronics endorsed VISP but urged caution about lack of availability of 1080 progressive equipment (consider use of 1080 interlace as gap filler).

– ATSC and Sony voiced strong objections to exclusion of 1080 interlace origination.

–

VISP 9723 Decision Matrix, Origination Options: Review

- Option 1: Add 1080 30i to VISP, no restrictions
    - Interlace Win / Progressive Loose
- Option 2: Add 1080 30i to VISP, limited duration (2 years)
    - Interlace Partial Win / Progressive Partial Loose (Camels nose)
- Option 3: Allow 1080 30i as Nyquest Oversampling Mode for SD progressive
    - VWG has sought expert opinions
        » Adds great complexity, cost, limited value
        » Loose/Loose
- Option 4: Allow dual use (1080 30i and progressive) Systems
    - Partial Interlace Win/ Partial Progressive Win
    - Commercial availability, yet meets intent of DoD progressive mandates

VISP 9723 Decision Matrix Options: Review (Cont.)

■ Option 5: Programmatic Deferral of all 1080 high temporal formats

   – Win / Win or No Deal

   – Consider 1080 24P and 30P Only

      » ATSC Table 3, DTV-MICL HD-1

   – 1080 50P and 60P Research and Development specifically endorsed

      » VWG Chair Action Item: Letter to SMPTE calling for 60P standards

   – 1080 > 30P Not authorized for any operational use (programmatic deferral)

      » Video Working Group will revisit 1080 maturity in 1999, every year thereafter

   – 1280 x 720 x 60P becomes the DoD/IC/USIGS High Definition Standard Format

      » "Most Correct" decision possible for 1998

VWG Chair: Recommendations

■ Define Maximum Image Quality Protection for HD <u>Production</u> Systems

- FCC: "<u>**By not adopting video formats, we are allowing consumers to choose which formats are most important to them**</u>"

- Progressive Scan is the "most correct" answer for DoD/IC/USIGS applications

- Improved image quality, improved compatibility with still imagery systems, improved compression efficiency, improved computer interoperability

- General industry consensus that 1080 progressive is the long term goal

- 1080 50/60P not ready for implementation in 1998, ready in 3-5 years
  - » No standards for 50/60P SDI, MPEG-2 issues

■ Professional opinion: 1280 x 720 x 60P is the "most correct" option for 1998

- Standards exist (format, SDI, MPEG-2), ATSC Table 3 compatibility, DTV-MICL HD1 compatibility, imminent commercial mainstream adoption

- Conclusion:

- Select 1280x720x60P as the DoD/IC/USIGS High Definition Video Standard

- Programmatic Deferral of operational use of 1080 high temporal formats until technology mature (encourage (promote) 1080 60P Research & Development, standards development)

High Definition Video Production (US DoD / Treaty Partners)

Horiz.	Vert.	Aspect	Aspect	Frame Rate						
1920	1080	16:9		24p	25p	30p		*50p*		*60p*
1280	720	16:9		24p	25p	30p		50p		60p

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VWG Recommendation to ISMC

■ VISP 1.22x found a way to find consensus

– IAW VWG Charter, VWG Chair is pleased to report to the ISMC a Consensus Based Document

■ Video Working Group recommends that the ISMC adopt the Video Imagery Standards Profile 1.22x, becomes Version 1.3

– One change: NITF 2.1 back to NITF 2.0

■ Video Working Group recommends that the ISMC Chair should recommend to the NIMA Representative to the JTA that the JTA should include VISP 1.3 in JTA 2.0 if possible.

Y2K Compliance in Video Standards

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13 February 1998

Time / Dates and Video

- SMPTE 12M (Time Code) standard is <u>the</u> universal time synchronization technology used by video, audio and television systems throughout the world
    - Built into every commercial tape recorder, editor, system, server, etc.
    - Imbeds a bit stream into the video vertical interval or as a separate tape track
- SMPTE 12M very, very successful, but existing standard has limitations
    - Hours / Minutes / Seconds / frames based, no standard for date or real-time
- Video Working Group representatives joined the SMPTE Engineering Standards Committee responsible for SMPTE 12M, proposed revisions to improve 12M to support DoD/IC/USIGS applications
- SMPTE committee warmly received our inputs, very successful partnership
    - After 18 months of work, brand new commercial standard was developed, significantly improves SMPTE 12M, makes it usable for DoD/IC/USIGS
    - New Standard: SMPTE 309M will be published Spring 1998

SMPTE 12M and SMPTE 309M

■ New SMPTE 12M revision supports "Real-Time" capabilities

  – "Bit-flag" change that allows time code systems to specify time code as "real-time" time of day

■ SMPTE 309M, entirely new standard, uses the User Data Bits of SMPTE12M in a standardized fashion:

  – Code groups to specify the date - only 6 digits available for date coding

  – Code group to specify time accuracy

■ SMPTE 309M was very difficult to develop

  – Significantly divergent opinions, some commercial interests insisted that there was no need to meet Y2K compliance, insisted on two digit years (YYMMDD)

  – VWG insisted that 309M had to be Y2K compliant to meet DoD/IC/USIGS requirements

  – VWG offered a compromise proposal - use of Modified Julian Date (MJD) (0DDDDD) instead of calendar date (YYMMDD)

    » MJD offers unambiguous date coding, meets Y2K criteria / intent

    » VWG compromise accepted by commercial interests, now formal part of standard (standard allows either YYMMDD or 0DDDDD)

    » Many major users (at least one TV network) like MJD version of 309M, expect to see wide implementations as soon as standard is published.

Modified Julian Date and SMPTE 309M

- Modified Julian Date: linear date counting from a fixed time in the past
  - Based on Julian Date (4713 BC), but JD problems: based on Noon start of day
  - MJD is JD - 2400000.5 (0.5 correction fixes the Noon issue, makes MJD match civil date, 2400000 correction makes five digit representation practical)
  - Current five digit MJD has "rollover" in 2131
    - » New 309M Standard uses six digit MJD, "rollover" not for 2000 years

- MJD is the native date format of GPS
  - Majority of DoD/IC/USIGS users use GPS time signals
  - COTS equipment available to lock SMPTE12M video time code to GPS signals
  - Very easy algorithm to convert MJD to civil date, civil date to MJD (part of 309M)
  - Use of MJD has been endorsed by the USNO

- 309M standard now mandated by VWG Video Imagery Standards Profile
  - Video will have MJD dates. If MJD is not natively stored by USIGS ingestion nodes (IPL, etc.) will have to convert MJD into YYYYMMDD, convert civil date back to MJD for video storage

- Summary: MJD (as implemented by 309M) yields unambiguous date coding - the intent behind Y2K policy.
  - Development of 309M demonstrated very successful VWG / commercial partnership (NIMA well respected by SMPTE engineers because of this work).
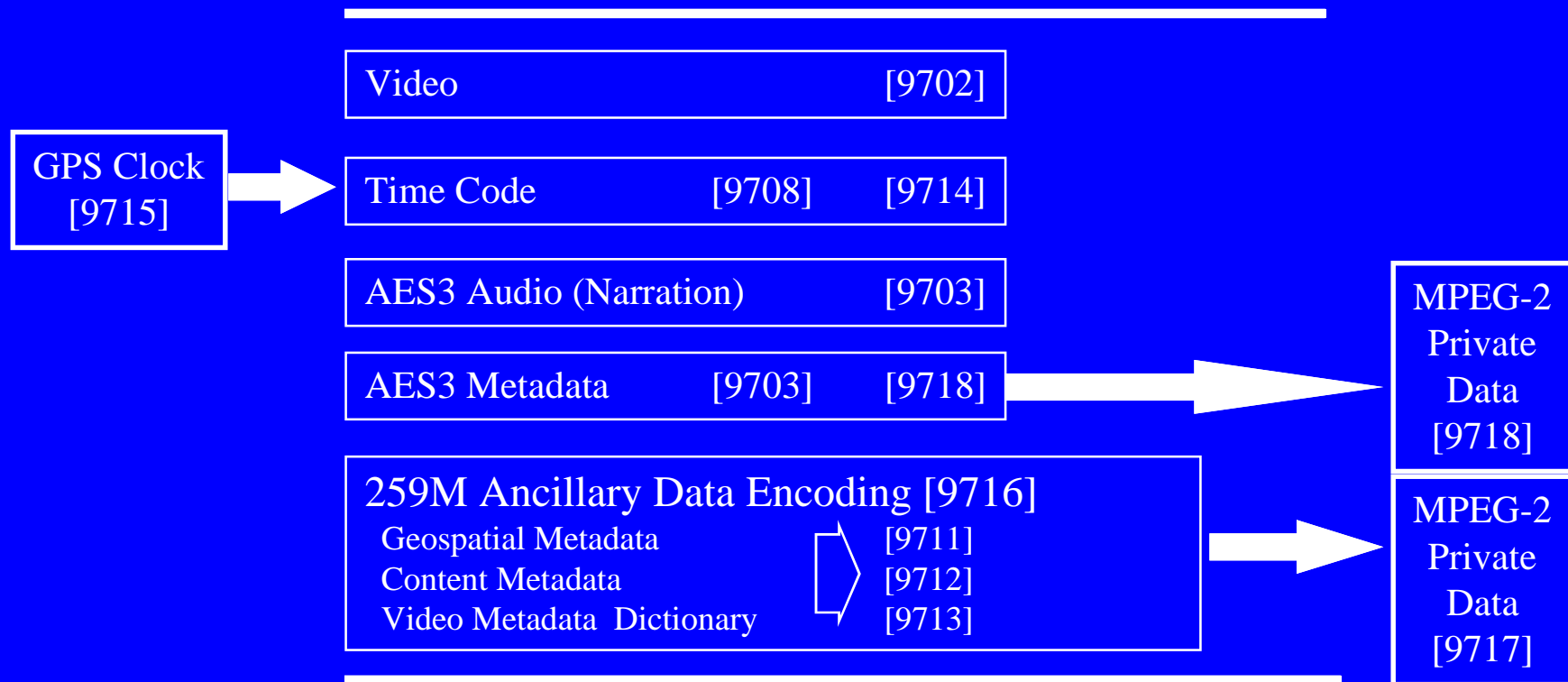

VWG VISP: Flow Diagrams of Standards, RPs &Studies

SMPTE 259M [9703]

| Video | [9702] |

GPS Clock [9715]

| Time Code | [9708] | [9714] |

| AES3 Audio (Narration) | [9703] |

| AES3 Metadata | [9703] | [9718] |

259M Ancillary Data Encoding [9716]		
Geospatial Metadata	[9711]
Content Metadata	[9712]
Video Metadata Dictionary	[9713]

MPEG-2 Private Data [9718]

MPEG-2 Private Data [9717]

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Back Up Slides

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High Definition Motion Imagery Issues for DoD/IC/USIGS and related Technology Programs

■ Critical Decision Point: the Future of High Definition Motion Imagery for Department of Defense / Intelligence Community / United States Imagery and Geospatial System (DoD/IC/USIGS) Communities

■ Major Interoperability / Cost Impacts

■ Video recognized by DoD/IC/USIGS as important source of imagery intelligence:

 – Real-time battlefield awareness, using video sensors such as UAVs has been key technological advancement driving DoD/IC/USIGS interest in video

 – Formulation of DoD/IC/USIGS Standards for High Definition Television are within responsibility (Charter) area of Video Working Group.

 – Technology development for High Definition Motion Imagery within responsibility area of new Video Technology Program (NIMA/ST/T)

 – S. Long, new Program Manager

Attributes of Commercial HD Video, DoD Applications

■ DoD/IC/USIGS Needs High Definition (720+ line) resolution for critical ISR

- – Improved video resolution directly translates to increased stand-off range for manned and unmanned reconnaissance video sensor platforms
- – High definition video sensors could support provide thousands of feet of increased altitude, moves platforms out of AAA threat rings
- – Wide Screen Format
- – Wider (16:9) Aspect Ratio, less "soda straw", more side coverage

■ Multiple DoD/IC/USIGS communities can share technology

- – Video Imagery
- – Video Telemedicine
- – Video Support

■ Use of commercial technologies to reduce costs

■ Use of commercial bandwidth infrastructures

Brief History / Outline of US High Definition Video Issues

■ 24 Dec 96 FCC Made Landmark Ruling on Digital Television for US

  – FCC issued its "4th Report and Ruling," based in large part on documents developed by the Advanced Television Systems Committee (ATSC)

  – ATSC documents/studies were ten plus years in the making

    » ATSC is an industry consortium

■ Table 3 refers to a table of 18 scanning formats in the ATSC Documents

■ Microsoft / Intel / Compaq / Lucent (DTV-MICL) Counter Proposal to Table 3

  – Based on the concept of a single Base Layer (HD0), upon which future upgrades can be added (HD1, HD2)

■ DTV-MICL proposals and Table 3 HD Proposals are not fully interoperable

  – Table 3 receivers will not decode DTV-MICL Enhancement (HD1, HD2) layers

  – DTV-MICL receivers will not receive native high definition portions of Table 3 transmissions

    » Very Ugly Consequences for Nation and DoD/IC/USIGS

Brief History / Outline of US High Definition Video Issues

■ Table 3 Adoption Specifically Excluded by the FCC: "Let the Market Decide,"

   – In absence of FCC Mandate, Any Scanning Format Allowable

      » Majority of Broadcasters / Receiver Manufacturers claim they will implement T3 even though no requirement by FCC to do so

   – Affirmative Statement that any service can ride on digital transport without further FCC rulemaking

FCC FOURTH REPORT AND ORDER
Adopted: Dec. 24, 1996 Released: Dec. 27, 1996

- 1. In this, the Fourth Report and Order in our digital television ("DTV") proceeding, we adopt a standard for the transmission of digital television. [1]

- [1 This standard will apply only to terrestrial digital television broadcasting and not to other video delivery services.]

- This standard is a modification of the ATSC [2] DTV Standard proposed in the Fifth Further Notice of Proposed Rule Making and is consistent with a consensus agreement voluntarily developed by a broad cross-section of parties, including the broadcasting, consumer equipment manufacturing and computer industries.[3] As explained below, **the Standard we adopt does not include requirements with respect to scanning formats, aspect ratios, and lines of resolution.**[4]   For clarity, we will refer to this modified standard as the "DTV Standard."

  - [2 "ATSC" is the Advanced Television Systems Committee. When it adopted the ATSC DTV Standard, the ATSC had 54 members including television networks, motion picture and television program producers, trade associations, television and other electronic equipment manufacturers and segments of the academic community. It was formed by the member organizations of the Joint Committee on InterSociety Coordination ("JCIC") for the purpose of exploring the need for and, where appropriate, to coordinate development of the documentation of ATV systems. The JCIC is composed of the Electronic Industries Association, the Institute of Electrical and Electronics Engineers, the National Association of Broadcasters, the National Cable Television Association, and the Society of Motion Picture and Television Engineers. The membership of the ATSC when it adopted the ATSC DTV Standard is at Appendix C of the Fifth Further Notice of Proposed Rule Making in MM Docket No. 87-268, 11 FCC Rcd 6235, 6269 (1996) ("Fifth Further Notice").]

  - [3 See letter of Broadcasters Caucus, Consumer Electronics Manufacturers Association and Computer Industry Coalition on Advanced Television Service, dated November 26, 1996 ("the Agreement"), at "(1)".]

  - [4 According to the Agreement, id., the "ATSC DTV Standard, including the Table 3 video format constraints, remains unchanged."]

FCC FOURTH REPORT AND ORDER
Adopted: Dec. 24, 1996 Released: Dec. 27, 1996

■ Comments: 11. There is likewise a range of opinion on the merits of the ATSC DTV Standard. Broadcasters, equipment manufacturers, the Grand Alliance, and ATSC urge the Commission to adopt the complete ATSC DTV Standard. [28] They contend that only a Commission-adopted standard will supply the certainty needed by all parties to undertake the transition to DTV and that the ATSC DTV Standard is the best DTV standard in the world. [29] **The Grand Alliance contends that "[t]he system's all-digital layered architecture, its packetized data transport structure, its use of headers and descriptors, its support of multiple picture formats and frame rates with a heavy emphasis on progressive scan [30] and square pixels, [31] and its compliance with MPEG-2 international compression and transport standards, give it unprecedented and unmatched interoperability with computers and telecommunications."[32]** (Footnotes added by FCC.)

  – [28 See, e.g., comments of Broadcasters at 34; comments of ATSC at 9; comments of Zenith at 7; comments of Sony at 12; comments of Thomson Consumer Electronics ("Thomson") at 6; comments of Grand Alliance at 9.]

  – [29 See, e.g., comments of Broadcasters at 18-19 and 34; comments of ATSC at 3, 6; Sony Electronics Inc. ("Sony") at 8.]

  – [30 In interlaced scanning, which is currently used in NTSC television, odd and even numbered lines of the picture are sent consecutively, as two separate fields. Alternate scans through the picture scan all even numbered, then all odd numbered lines. These two fields are superimposed to create one frame, or complete picture, at the receiver. In progressive scanning, instead of skipping rows as in interlaced scanning, each line is scanned in succession from the top of the picture to the bottom, with a complete image sent in each frame. This type scanning is commonly found in computer displays today.   ]

  – [31 A pixel is an abbreviation for "picture element," the smallest distinguishable portion of a picture. "Square pixels" means that picture elements are equally spaced in the vertical and horizontal direction. This simplifies computer processing of images.   Comments of the ATSC at 20, fn 12.]

  – [32 Comments of HDTV Grand Alliance at 17-18. See also comments of ATSC at 3, and EIA at 9.]

  – [33 Comments of CICATS at 31-37.7]

FCC FOURTH REPORT AND ORDER
Adopted: Dec. 24, 1996 Released: Dec. 27, 1996

18. Supporters of the Standard respond that it is far more computer friendly than any other digital television system in use anywhere in the world, relying as it does primarily on progressive scan and square pixels. [57] **While these commenters assert that current technology prohibits the use of progressive scanning for images of more than 1000 lines in the 6 MHz channel, they concede that an all progressive system would be preferred once possible.** [58] In the interim, convergence will not be hampered because the Standard enables consumers to choose the display formats they prefer, as interlaced programs may be displayed on progressive receivers (and vice versa). In any case, supporters of the Standard assert that interlaced source material will continue to be widely used for many years and progressive scan receivers such as those advocated by computer interests will have to include a deinterlacer even if only to display NTSC transmissions during the simulcast period. [59] Moreover, they contend that there are already PC/TV products on the market using analog NTSC technology, which relies on interlace scanning, thus proving that interlaced scanning is not incompatible with computers. [60] Therefore, they do not believe it credible that the introduction of the primarily progressive scan ATSC DTV Standard would somehow stymie further convergence, especially given its flexible design which permits future innovations to be accommodated.

[57 See, e.g., comments of the Grand Alliance at 3.]

[58 See, e.g., comments of Matsushita Electric Corp. of America at 8. ("There is broad consensus among technical experts that all progressive HDTV production is the goal, the power and flexibility of the ATSC ATV (sic) standard has been crafted to provide it and MECA is investing its resources in achieving that goal.") See also comments of the Grand Alliance at 21. ("[T]he Grand Alliance generally agrees that progressive scan is the preferred mode for text and graphics material....")(Emphasis in original.)   ]

[59 Reply comments of the Grand Alliance at 48.]

[60 Id.]

FCC FOURTH REPORT AND ORDER
Adopted: Dec. 24, 1996 Released: Dec. 27, 1996

- The National Telecommunications and Information Administration ("NTIA") stresses the need for a single mandatory DTV standard but recommends limiting a standard to only those elements necessary to provide certainty, encourage adoption, ensure the opportunity for technological developments, and **promote evolution to an all-progressive scan system**.[34]

  – [34 Comments of NTIA at 1-3.]

- **Department of Defense does not directly address the Agreement but voices its concern over any use of interlaced scanning and non-square pixels. [86] It strongly favors progressive scanning and square pixels because, it states, they result in operations that are cheaper, faster, and computer compatible for DOD information processing applications.**

- [86 Comments of the Department of Defense, The Under Secretary of Defense in response to the Public Notice at 1.]

- 39. Third, we conclude that incorporating the DTV Standard into our Rules will encourage technological innovation and competition. In particular, we conclude that our decision not to specify video formats will result in greater choice and diversity of equipment, allow computer equipment and software firms more opportunity to compete by promoting interoperability, and result in greater consumer benefits by allowing an increase in the availability of new products and services**. By not adopting video formats, we are allowing consumers to choose which formats are most important to them**. Thus, we avoid the possibility that we could inhibit development of services which might, in fact, draw consumers more readily to embrace digital broadcasting and thus, hasten its adoption. By not specifying video formats in this respect we foster competition among those aspects of the technology where we are least able to predict the outcome, choosing instead to rely upon the market and consumer demand.

ATSC A.53 Citations

■ 2. REFERENCES

– …The Digital Television Standard is based on the ISO/IEC MPEG-2 Video Standard…

– …high level: A range of allowed picture parameters defined by the MPEG-2 video coding specification which corresponds to high definition television…

– …main level: A range of allowed picture parameters defined by the MPEG-2 video coding specification with maximum resolution equivalent to ITU-R Recommendation 601…

– …main profile: A subset of the syntax of the MPEG-2 video coding specification that is expected to be supported over a large range of applications…

– …The digital television system employs the MPEG-2 transport stream syntax for the packetization and multiplexing of video, audio, and data signals for digital broadcasting systems…

– 2.1 Normative references

– The following documents contain provisions which, through reference in this text, constitute provisions of this standard…

  » ISO/IEC IS 13818-1, International Standard (1994), MPEG-2 Systems.
  » ISO/IEC IS 13818-2, International Standard (1994), MPEG-2 Video.

ATSC A.53 Citations

■ 2.2 Informative references

– SMPTE 274M (1995), Standard for television, 1920 x 1080 Scanning and Interface.

– SMPTE S17.392 (1995), Proposed Standard for television, 1280 x 720 Scanning and Interface.

– ITU-R BT.601-4 (1994), Encoding parameters of digital television for studios.

■ 4. POSSIBLE VIDEO INPUTS

– While not required by this standard, there are certain television production standards, shown in Table 1, that define video formats that relate to compression formats specified by this standard.

– Table 1 Standardized Video Input Formats

Video standard	Active lines	Active samples/ line
SMPTE 274M	1080	1920
SMPTE S17.392	720	1280
ITU-R BT.601-4	483	720

■ The compression formats may be derived from one or more appropriate video input formats. It may be anticipated that additional video production standards will be developed in the future that extend the number of possible input formats.

ATSC A.53 Citations

■ 5. SOURCE CODING SPECIFICATION

– The ATV video compression algorithm shall conform to the Main Profile syntax of ISO/IEC 13818-2. The allowable parameters shall be bounded by the upper limits specified for the Main Profile at High Level.

– 5.1 Constraints with respect to ISO/IEC 13818-2 Main Profile

– The following tables list the allowed values for each of the ISO/IEC 13818-2 syntactic elements which are restricted beyond the limits imposed by MP@HL.

– …The preferred and default values for color_primaries, transfer_ characteristics, and matrix_coefficients are defined to be SMPTE 274M… While all values described by MPEG-2 are allowed in the transmitted bit stream, it is noted that SMPTE 170M values…will be the most likely alternate in common use….

–

Video Program Manager: Recommendations (Cont.)

■ Define Maximum Image Quality Protection for HD <u>Production</u> Systems

- FCC: "**<u>By not adopting video formats, we are allowing consumers to choose which formats are most important to them</u>**"

- Progressive Scan is the "most correct" answer for DoD/IC/USIGS applications

- Improved image quality, improved compatibility with still imagery systems, improved compression efficiency, improved computer interoperability

- General industry consensus that 1080 progressive is the long term goal

- 1080 50/60P not ready for implementation in 1998, ready in 3-5 years
  » No standards for 50/60P SDI, MPEG-2 issues

■ Professional opinion: 1280 x 720 x 60P is the "most correct" option for 1998

- Standards exist (format, SDI, MPEG-2), ATSC Table 3 compatibility, DTV-MICL HD1 compatibility, imminent commercial mainstream adoption

- Conclusion:

- Select 1280x720x60P as the DoD/IC/USIGS High Definition Video Standard

- Programmatic Deferral of operational use of 1080 formats until technology mature
  » Encourage (promote) 1080 60P Research & Development, standards development

Technology Office Action Items

■ Proactive work with SMPTE / DTV-MICL / ATSC

– Define 1080 60P standards (need SDI, MPEG-2 extensions)

– Define due-process "layer" standards

– Urge HD0 migration up from 720 24P to 720 30P, development of HD0 30P systems that extract MPEG-2 "I" frames from 60p, screens do not go black

– Urge development of standards that allow commercial users to use 1080/30I for production, but urge conversion to progressive prior to transmission.

– Encourage (promote) 1080 60P Research & Development